

FEDERAL AID IN SPORT FISH RESTORATION
Juneau Chinook and Coho Salmon
Recreational Fisheries Enhancement

by
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RESEARCH PROJECT SEGMENT

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Study Title: JUNEAU CHINOOK AND COHO
SALMON RECREATIONAL
FISHERIES ENHANCEMENT

Cooperator: Ron Josephson

Period Covered: January 1, 1986 to September 30, 1986

ABSTRACT

In 1986 seven groups of chinook salmon, *Oncorhynchus tshawytscha*, smolts and one group of coho salmon, *Oncorhynchus kisutch*, smolts from Snettisham Hatchery were released in the Juneau area. Smolts were released at five different sites and under three different imprinting strategies. Similar groups were released at Snettisham Hatchery. All groups of smolts were coded-wire-tagged for future evaluation of survival and contribution to commercial and marine fisheries.

Key Words: Chinook salmon, *Oncorhynchus tshawytscha*, Coho salmon, *Oncorhynchus kisutch*, imprinting, enhancement

INTRODUCTION

There is a need to enhance recreational fishing opportunities for chinook salmon, *Oncorhynchus tshawytscha*, and coho salmon, *Oncorhynchus kisutch*, in the Juneau area. An increase in the local population has been accompanied by an increase in sport fishing effort. Area streams support small runs of coho salmon but no chinook salmon. It is unlikely that the production capacity of these streams can support the fishing pressure of the local population.

This project is designed to test different imprinting and release strategies and determine which strategy results in the greatest return and sport harvest of planted chinook and coho salmon.

RECOMMENDATIONS

1. Continue the planting of chinook and coho salmon smolt in the Juneau area to enhance local sport fisheries in the marine and terminal freshwater areas.
2. Continue to test release and imprint strategies to determine site-specific methods which provide the greatest sport harvest in the most cost effective manner.

OBJECTIVES

1. Provide through the 1986 releases an additional harvest of 1,336 adult chinook salmon and 50 adult coho salmon in the Juneau marine sport fishery during 1987-1991.
2. Provide through the 1986 releases an additional harvest of 324 adult chinook salmon and 200 adult coho salmon in the terminal freshwater sport fisheries during 1987-1991.
3. Determine chinook and coho salmon production from four release sites as well as the production resulting from selected imprinting strategies at two of these sites.

MATERIALS AND METHODS

Smolt Production

Chinook and coho salmon for this project were the result of spawning operations in 1984. The chinook salmon were collected

as eggs at Crystal Lake Hatchery and transported to Snettisham Hatchery for incubation and rearing. The coho salmon were from Snettisham Hatchery returns; salmon smolts were produced using standard hatchery methods. Fish for the Juneau stocking came out of production groups at Snettisham Hatchery.

Tagging

The fish in seven groups of approximately 30,000 chinook salmon and one group of 20,000 coho salmon intended for release in the Juneau area were marked and tagged with an adipose clip and a coded-wire tag, respectively, during January through May; the chinook and coho salmon in the production lots were also marked and tagged so that the survivals from releases at the hatchery can be compared to those of the fish released remotely. Tagged groups of 30,000 chinook salmon and 20,000 coho salmon should allow for a 95% chance of detecting a 50% difference in survival between groups based on our adult fish return and fishery exploitation expectations.

After tagging, the chinook salmon were placed in raceways that were divided in half by screens; approximately 7 days later fish in the rear halves began exhibiting a whirling behavior when disturbed and suffering an increased mortality. We moved these groups of fish to other raceways, and the mortality diminished, although the behavior still continued when the fish were disturbed. The FRED Division Pathology Section staff were unable to identify an etiological agent. The most probable cause was thought to be a toxin. As the raceways were new, a curing compound may have been involved. Analysis of water from the raceways indicated high levels of oil and grease that may also have been involved. Because of the obvious stress placed on these groups of chinook salmon, they can not be considered comparable. A subject stress index of between 1 and 3 was assigned to each tagged group: 1 indicating the least severe stress level (i.e., no significant indicator of stress), 2 indicating a medium stress level, and 3 indicating the most

stressed level (i.e., high mortalities and continued whirling behavior still evident at release).

Transport

We transported salmon smolts to Juneau using a variety of methods; the primary one was in fiberglass tanks (1.9 cubic meters) supplied with oxygen aeration. The transport tanks each held 30,000 smolts in hatchery process water with 1% salt (NaCl) added. Generally the transport tanks were loaded in the hold of a landing craft and transported to the Juneau sites where fish were released or put into net pens. Smolts were also transported in 121-liter plastic containers that typically held 76 liters of oxygenated hatchery-process water with 1% salt added. These containers were transported in either a DeHaviland Beaver aircraft or a Bell 212 helicopter to the release sites at Salmon Creek and Montana Creek.

Imprinting and Release

It is generally accepted that juvenile salmon transported to a new stream during or before active emigration begins will imprint and return to that stream. Salmon imprinting is associated with a period of the rapid learning of cues identifying the home tributary at the time of smoltification. Rounsefell and Kelez (1938) transferred presmolt coho salmon from their native river to a different river, and the fish returned as adults to the second river. Anadromous salmonids raised in a hatchery and transplanted before smoltification return to the river of release (Donaldson and Allen 1957; Mahnken and Jagner 1973; Aho 1975; Wahle 1975). There is evidence that the smoltification process is rapid. Jensen and Duncan (1971) transplanted coho salmon just as they began to smoltify; the fish emigrated from the river within 2 days and returned to it during the spawning migration. Mighell (1975) found that 4 hours was a sufficient time period to hold coho salmon smolts in a new stream to ensure homing to it.

In contrast, Peck (1970) transplanted coho salmon several weeks after smoltification and observed low return rates and widespread straying to other streams. Two conclusions can be drawn from these studies: (1) the memory of the home stream does not appear to be inherited, and (2) homing is connected with a period of rapid and irreversible learning of cues that identify the home stream at the time juvenile coho salmon begin their downstream migration.

Each release site in this study required slightly different rearing and/or release strategies because of its specific characteristics. However, when possible, all releases of a species occurred at the same date and time to make comparisons more valid. All groups of chinook salmon released contained approximately 30,000 fish, while the coho salmon group contained approximately 20,000 fish. Fish held in net pens were fed a commercial diet daily.

Auke Creek:

The releases at Auke Creek were conducted cooperatively with the National Marine Fisheries Service (NMFS). There were three distinct groups of chinook salmon released at this site. Two releases involved holding chinook salmon in saltwater net pens for 14 days. The pens were placed as close to Auke Creek as tidal conditions allowed (approx. 200 m). Each pen was 6 m in each dimension. One pen (designated the freshwater pen) had a plastic barrier on the uppermost 1.5 m and was supplied with freshwater via a pipeline from Auke Creek. The barrier maintained a freshwater lens on the surface to ensure presence of imprinting water. The second pen (designated the tidal pen) relied on natural flow and tidal action to provide adequate Auke Creek water for imprinting. The remaining group of chinook salmon were not held in net pens but released directly into the mouth of Auke Creek. This release was on a high tide to enable the landing craft to gain entrance to the creek and to provide

the maximal freshwater area. Smolts held in net pens were released immediately after the direct release.

Fish Creek:

There were two releases of chinook salmon at Fish Creek. The first group was held for 12 days in a net pen located in a freshwater pond adjacent to Fish Creek. The pond is approximately 100 m by 30 m and connected to Fish Creek by a 12-m-wide and 10-m-long channel. The pond is subject to tidal flow above the 3-m tide stage. This pen was 11 m by 11 m by 3 m deep and was provided by Douglas Island Pink and Chum (DIPAC), Incorporated under an existing cooperative agreement. The second group was released directly into the mouth of Fish Creek using the same approach employed at Auke Creek. Smolts held in the net pen were released immediately after the direct release.

Montana Creek:

The group of chinook salmon released at Montana Creek was transported to the upper reaches of the creek 10 km above tide water. They were transported in a Bell 212 helicopter and released directly in a pool in the creek.

Sheep Creek:

Under an existing agreement, the Sheep Creek releases were conducted cooperatively with DIPAC, who operate a hatchery at this site. The group of chinook salmon released was held in a saltwater net pen for a period of 12 days. The pen was 11 m by 11 m by 3 m deep and had a plastic barrier on the uppermost 1 m to retain freshwater supplied by a pipeline from Sheep Creek.

Salmon Creek:

At Salmon Creek there were two groups of coho salmon released. The fish were transported in a DeHaviland Beaver. The smolts

were held for a period of 36 hours in two 2.5-cubic-meter ponds that were provided with Salmon Creek water for imprinting purposes. Smolts were released directly into Salmon Creek under the cover of darkness. The releases were separated by 48 hours but will be evaluated as one group.

RESULTS

Tagging

All tagging for this project was conducted at Snettisham Hatchery during 1986.

Coho Salmon:

The coho salmon were tagged between 11 and 15 February. There were 20,597 fish tagged for Juneau stocking and 22,187 fish tagged for Snettisham release. Table 1 outlines the tagging results.

Chinook Salmon:

The chinook salmon were tagged between 15 April and 8 May; 210,721 fish were tagged for Juneau stocking and 57,689 fish were tagged for Snettisham release. Table 2 outlines the tagging results and provides the stress index.

Transport

All transports went exceptionally well. Groups of chinook salmon transported in the 1.9-cubic-meter tanks were loaded at a density of 0.15 kg /liter for the 8- to 10-hour transport; handling mortalities of 8- to 12-fish/transport were considered insignificant. The chinook salmon transported in the helicopter to Montana Creek were loaded at a density of 0.33 kg/liter for the

Table 1. Summary of coho salmon tagging at Snettisham Hatchery, 1986. (DJ projects only)

Brood year	Tag code	Number tagged	Tagging dates	Stocking destination
1984	4-23-61	20,597	2/11 - 2/13	Salmon Creek
1984	4-25-41	11,451	2/13 - 2/15	Snettisham ;
1984	4-25-42	10,736	2/13 - 2/15	Snettisham

Table 2. Summary of chinook salmon tagging at Snettisham Hatchery, 1986. (DJ projects only)

Brood year	Tag code	Number tagged	Tagging dates	Stocking site	Stress index ¹
1984	4-26-1	30,640	4/15 - 4/17	Auke Creek	1
1984	4-26-2	30,231	4/17 - 4/19	Montana Creek	2
1984	4-26-3	30,933	4/19 - 4/21	Auke Creek	1
1984	4-26-4	30,444	4/21 - 4/23	Snettisham	3
1984	4-26-5	30,880	4/30 - 5/1	Fish Creek	1
1984	4-26-6	30,705	5/1 - 5/3	Sheep Creek	1
1984	4-26-7	30,409	5/3 - 5/5	Fish Creek	1
1984	4-26-8	26,923	5/5 - 5/8	Auke Creek	1
1984	4-26-9	27,245	5/6 - 5/8	Snettisham	1

¹ The stress index was a subjective evaluation of fish health based on behavior and mortality. It was assigned after an apparent toxic agent affected fish health. Survival comparisons between groups would not be valid if stress indexes were not equal.

1-hour transport. The group of coho salmon transported to Salmon Creek was loaded at 0.24 kg/liter for the 1-hour transport. A DeHaviland Beaver with amphibious floats was loaded on the runway at Snettisham and flew directly to Twin Lakes in Juneau. The plastic containers of fish were then hand-carried to the two 2.5-cubic-meter ponds supplied with Salmon Creek water.

Imprinting and Release

Success of the actual imprinting will not be known until we get adult returns from the releases; however, in all cases when fish were held for a period of time, they did well and were actively feeding prior to their release. We assume that this is indicative of the fish adapting and imprinting to the new environment.

Releases of chinook salmon in the Juneau area were scheduled near twilight to allow smolts the opportunity to disperse under the cover of darkness. On the same night, Snettisham releases occurred after dark, but with more attention to the tide because of physical characteristics of the site. Release dates, times, numbers, tag codes, and smolt sizes for chinook salmon are presented in Table 3. Release sizes may be biased because of the difficulty of sampling in large net pens.

The coho salmon releases were also made under the cover of darkness; they are summarized in Table 4.

DISCUSSION

The releases of chinook and coho salmon smolt conducted in 1986 can be expected to produce more fish for sport fishermen in the Juneau area. All the smolts looked very good upon release and are expected to equal or exceed the survival rates of comparable releases at Snettisham Hatchery. In 1985 there was a release of coho salmon in the Juneau area at Dredge Lake. Returns from that

Table 3. Summary of chinook salmon smolt releases in the Juneau area and related Snettisham Hatchery releases, 1986.

Release site	Treatment (# days)	Tag code	Number released	Released		Percent tag retention	Size	
				Date	Time		gm	mm
Auke Creek	Tidal (14)	4-26-1	29,003	5 June	2200	88.6	9.0	90.7
Auke Creek	Freshwater (14)	4-26-3	29,737	5 June	2200	95.0	9.1	90.7
Auke Creek	Direct	4-26-8	26,896	5 June	2130	97.2	8.0	88.6
Fish Creek	Tidal (12)	4-26-7	29,652	5 June	2300	98.0	8.4	86.6
Fish Creek	Direct	4-26-5	30,620	5 June	2245	91.2	7.5	85.7
Montana Creek	Direct	4-26-2	28,335	5 June	1530	91.8	8.4	90.7
Sheep Creek	Freshwater (12)	4-26-6	30,280	5 June	2300	93.2	7.7	86.0
Snettisham	Freshwater (life) ²	4-26-4	22,560	6 June	0200	94.6	7.8	87.4
Snettisham	Freshwater (life) ²	4-26-9	27,222	6 June	0200	99.6	8.1	87.0

¹ The three general release treatments were: Direct, a release directly from the transport container at the release site; tidal, a release from a net pen provided with imprinting water primarily by tidal flow; freshwater, a release from a net pen or raceway directly provided with the desired imprinting water.

² Full life cycle up to release was spent at Snettisham.

Table 4. Summary of coho salmon smolt releases in the Juneau area and related Snettisham Hatchery releases, 1986.

Release site	Tag code	Number released	Number tagged	Released		Percent tag retention	Size	
				Date	Time		gm	mm
Salmon Creek	4-23-61	20,422	20,422	(50%)19 June	2230	95.4	9.4	92.0
				(50%)21 June	2230	95.4		
Snettisham	4-25-41	88,000	11,361	17 June	2330	92.67	8.6	90.9
Snettisham	4-25-42	83,000	10,652	17 June	2330	92.67	8.6	90.9

release are four times those of a comparable release at Snettisham. More importantly, this prior release of coho salmon in the Juneau-area exceeded our survival assumptions for the marine harvest alone. Additionally in 1986, as part of a study on chinook salmon rearing, NMFS recovered smolts in Auke Bay from the Juneau release. All tag groups were represented, and indications were that the smolts had made the transition to the marine environment.

Returns from the 1986 release will begin in 1987 with adult coho salmon; chinook salmon adults will begin returning in 1989, with chinook salmon jack returns in 1987 and 1988. Future reports will present adult returns and the degree to which objectives were realized. To maintain continuity of this project, releases in 1987 should occur at the same sites and follow similar procedures as 1986 releases.

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